MINERALOGRAPHIC STUDY OF SPECIMENS FROM THE ROBSON GROUP - BONANZA BASIN PART OF TYAUGHTON LAKE MAP AREA, BRITISH COLUMBIA

A report submitted in Partial
Fulfillment of the Course Requirements
Geology 409
University of British Columbia

by

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March 1959

ACKNOWLEDGMENTS

The writer gratefully acknowledges the assistance given in the examination of the specimens by Dr. R.M. Thompson who also provided the ore specimens.

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MINERALOGRAPHIC STUDY OF SPECIMENS FROM THE ROBSON GROUP - BONANZA BASIN PART OF TYAUGHTON LAKE MAP AREA, BRITISH COLUMBIA

Introduction

Tyaughton Lake map-area lies on the eastern flank of the Coast Mountains and particularly in its southern and southwestern parts, and is extremely rugged and difficult of access. North of Gun Creek, where the Bonanza Basin is located, the topographic expression is more modulated; valley slopes, especially those with southern exposures, are open or sparsely timbered, and travel is relatively easy. The area is tributary to Bridge River, and is accessible by motor road from Shalath on the Pacific Great Eastern Railway, a distance of about 35 miles.

The Robson Group property itself, as shown on the following map is located in the vicinity of Bon and Nea Creeks and covers 16 claims lying 2.4 miles W. of longitude 122°50' and 1.2 miles North of 51°00'. The cabin at the property is at 6000' elevation. The property is reached by road from Minto to the Lucky Strike gold mine in the Taylor basin, then by a 2.5 mile pack trail over an 8000' divide into Bon (Bonanza basin). An alternative route may be followed from

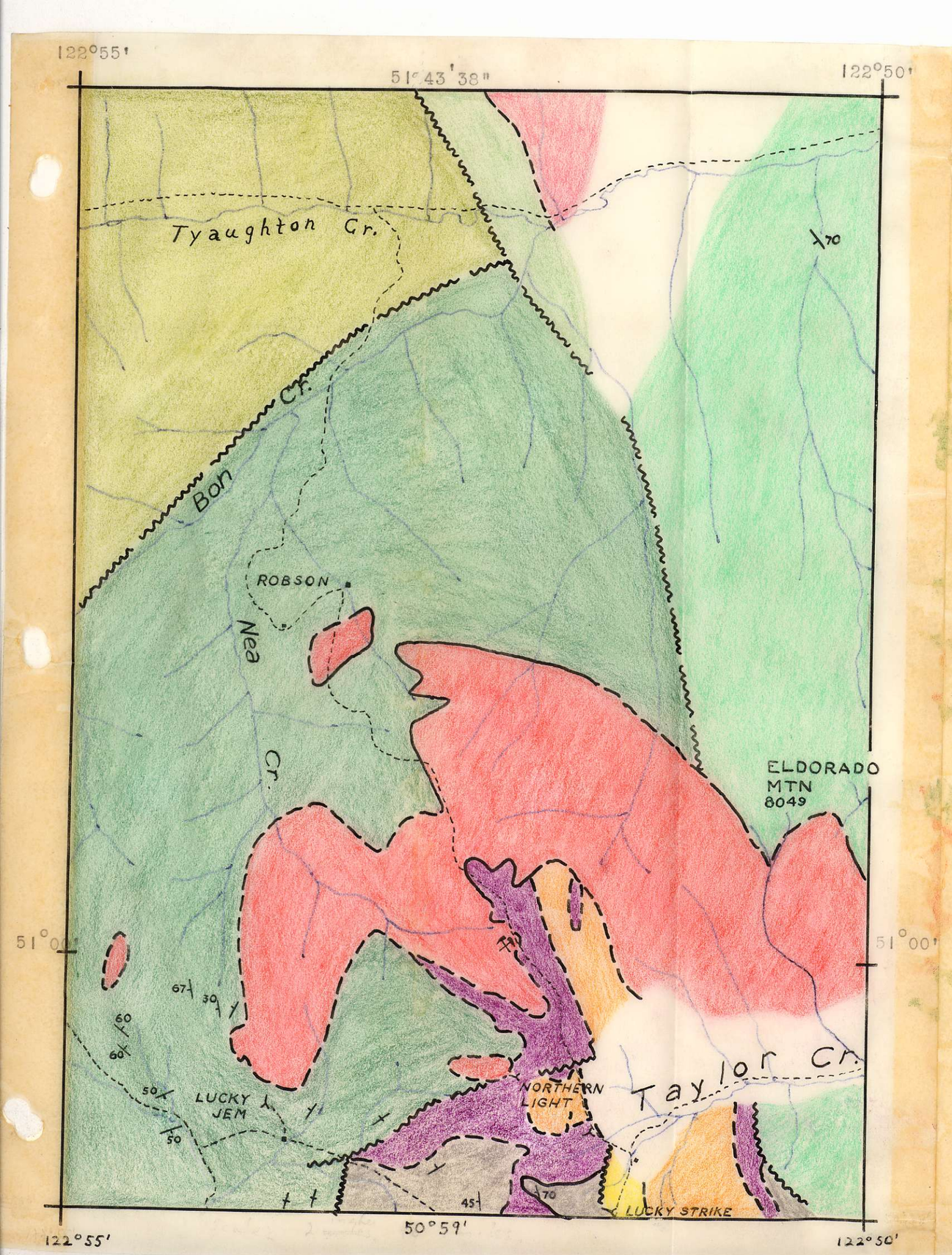
Minto; 18 miles by road to Empire Mercury mine, then by pack trail for 6 miles up Tyaughton Creek on an easy grade.

Considerable prospecting has been done over a long period in the basin of Bon (Bonanza) Creek. It was first explored by Mr. Pearson in 1912,and about 1933, Mr. Cooper Drabble of Bridge River and Vancouver and associate acquired some thirty claims in the basin and proceded to prospect them more thoroughly. Altogether numerous veins were encountered, but few of them presented prospects of any considerable tonnage and, apparently, the claims were allowed to lapse. More recently other claims have been staked and some underground mining attempted. In 1940 the J.G. Mining Company, of which Messrs. J.G. Robson and J.A. Anderson were the principals, owned the Robson group of claims on which Bralorne Mines, Limited, held an examining option for six weeks.

To the knowledge of the writer no commercial production has been reported from that property.

The vicinity of the Robson property was mapped as part of the Tyaughton Lake map area surveyed by C.E. Cairnes in 1937 and C.H. Crickmay 1939, for the Geological Survey of Canada. The geological compilation has been done by C.E. Cairnes and the report (paper 43-15) published in 1943.

The following section of this report on the general geology in the vicinity of the Robson property is a summary taken mainly from the previously mentioned paper.



LEGEND

Tertiary: Cretaceous or Tertiary

- Minor intrusions
- Coast Range Intrusions
- Ultrabasic intrusions

Jurassic and Lower Cretaceous

- Eldorado Group

Middle or Upper Jurassic

- Taylor Group

Upper Trassic

- Tyaughton Group

Triassic

- Hurley Group
- Pioneer Formation
- Noel Formation

Permian (?)

- Fergusson Group

SYMBOLS

- Geological contact
- Fault
- Bedding (inclined, vertical)
- Prospect
- Mining property ROBSON
- Adit
- Trail

GEOLOGY IN THE VICINITY OF THE ROBSON PROPERTY

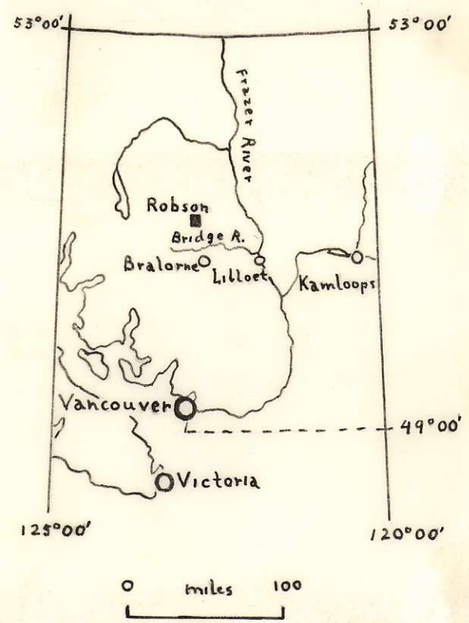
from

GEOLOGY AND MINERAL DEPOSITS OF TYAUGHTON LAKE MAP_AREA: British Columbia

G. S. C.

Paper 43_15

Scale:-2 inches to 1 mile



General Geology in the Vicinity of the Robson Property

Sedimentary and Volcanic Rocks

Fergusson Group

The oldest rocks in the map-area, those of the Fergusson group occur south of Robson near the Lucky Strike property. They consist of an alternative succession of sedimentary and volcanic rocks. The former comprise, very largely, thinly bedded, often much contoured chert, with argillaceous parting between the chert "ribbons". Colors are mostly light to dary grey, but vary to dark bluish grey, greenish grey, buff and reddish.

No diagnostic fossils were found in the formations of the Fergusson group, but it is definitely pre-Upper Triassic and is placed tentatively in the Late Paleozoic, probably Permian.

Noel Formation

Sedimentary rocks of the Noel formation overlie Fergusson beds and are exposed north and east of the former, south of Robson. They consist of banded and massive, grey to greenish grey, argillaceous and tuffaceous sedimentary beds, intercalated with occasional narrow belts of volcanic material. The formation is structurally conformable with underlying Fergusson strata, but contacts may be disconformable.

Bodies of metamorphosed, chiefly sedimentary rocks observed in various parts of the map-area are probably, in the main, altered equivalents of the Noel formation, but may include some Fergusson strata. They comprise bleached, reddish brown and mottled dense quartzitic, argillaceous, and cherty beds, commonly heavily biotitized, and associated with some greenstone schists of volcan[redacted].

Pioneer Formation

The Pioneer Formation of essentially volcanic rocks mainly green, massive fine-grained to porphyritic andesitic lavas and pyroclastic rocks occur as small exposures near Lucky Strike property. Its relations with the Noel seem to be partly conformable and partly intrusive.

Hurley Group

The Robson property is in the Hurley Group which comprise a major part of the geological formations in the vicinity of the property. The Hurley group of mainly sedimentary rocks overlies the Pioneer formation with apparent conformity, except where in faulted contact, and has provided scattered fossil collections, among which some Triassic forms have been recognized.

The group comprises an abundance and variety of argillaceous and fine-grained tuffaceous beds, conglomeratic beds some limestone and here and there minor intercalations of

volcanic rocks. Much of the Hurley sedimentary material is distinctly limy, as contrasted with that of the Noel formation and the Eldorado group. The conglomeratic beds contain a variety of pebbles and cobbles of sedimentary, volcanic, and perhaps intrusive rocks, among which greenish volcanic rocks, light coloured felsites and porphyries, and dark argillaceous and cherty sedimentary types are generally conspicuous. Many of the beds also contain both well-rounded and quite angular fragments of limestone.

There is much faulting in the Hurley Group and no complete section of strata was observed, but the group must comprise several thousand feet of beds. The beds of the fault blocks commonly stand at high angles and the stratigraphic relations between one block and another are doubtful. The general structure appears to be synclinal to basin shaped.

Farther north, on slopes leading down to Tyaughton Creek, the prevailing rocks are grey to black, dense to cherty types, and around the exposed granitic intrusions are considerably indurated, metamorphosed, and in places conspicuously pyritized.

Tyaughton Group

The Tyaughton Group is, on the whole, the most distinctive assemblage of sedimentary rocks in the map-area. Its contacts with the Hurley group, north west of Robson property, indicate faulted relationships. It is probably, however, that no very considerable time interval separates the

two groups, as at least a large part of the Tyaughton is of Upper Triassic age.

The rocks consist of interbedded grey, green and reddish sandstone, shale, grit, conglomerate, and limestone, as well as thick beds of light grey limestone. No tuffaceous types, so common in both older and younger groups were noted in the Tyaughton rocks. On the whole the rocks are remarkably fresh and unmetamorphosed, and though intersected by many faults are no more deformed than adjacent much younger strata.

Taylor Group

The Taylor group is characterized chiefly by an abundance of conglomeratic rocks, but includes, as well, great thicknesses of finer-grained clastic materials and minor intercalations of volcanic rocks. The lower part, occurring at Eldorado mountain, consists mainly of coarse to fine conglomerate, grit, sandstone, shale, argillite and minor green volcanic rocks. The upper part occurring in faulted contact with Hurley group, east of Robson property, includes mainly chert, pebble conglomerate, micaceous arkosic sandstone, shale and argillaceous and tuffaceous beds.

The group comprises altogether several thousand feet of beds and it is intruded, like the Hurley group, by Coast Range batholithic rocks.

Eldorado Group

The Eldorado group consists mainly of massive to thinly

bedded dark argillaceous and tuffaceous beds in part dense and flinty. Grey and green sandstone, shale, conglomerate, plus massive, dark green tuffs breccias, and tuffaceous sedimentary rocks.

Intrusive Rocks

Ultrabasic Intrusions

South of the Robson property, near Northern Light an irregular-shaped and small body of altered ultrabasic rocks occurs. It consists of serpentine and partly serpentinized peridotites and dunites and form massive to highly sheared and polished dark green rocks that in places may be difficult to distinguish from sheared and altered green volcanic rocks. Alteration of the serpentine bodies by hydrothermal solutions has, in many places, resulted in their almost complete transformation to magnesium-bearing carbonated talc, free quartz, and commonly, a bright green micaceous mineral resembling mariposite.

Coast Range Batholitic Rocks

The Coast Range intrusive rocks form an irregular stock size body and two smaller ($\frac{1}{4}$ mile long) bodies mainly through the Hurley group where lies the Robson property. It is a medium-grained, massive to somewhat foliated rock commonly carrying both biotite and hornblende and with a composition that varies mostly from basic granodiorite to siliceous quartz diorite.

Minor Intrusions

Occurring north of Robson, this minor intrusion consists of medium to coarse-grained, pink, porphyritic rocks having about the composition of a biotite syenite or quartz syenite.

Auriferous Deposits Related to Coast Range Intrusions

General

Gold-bearing deposits related to the Coast Range intrusive rocks cover rather a wide range of types and occur partly within and partly without the intrusive masses with which they are presumed to be genetically related. This view is partly substantiated by the fact that both near the deposits and also where no discoveries have yet been made, the intrusive bodies near their borders carry disseminations and small lenticular masses of sulphide minerals. Most of the significant deposits are veins or veins and replacement bodies occurring along fissures in the intrusive rocks or along fissures or shear zones in the older, invaded formations. Within the map-area these deposits are composed mainly of sulphides with relatively little gangue minerals. The proportions and variety of sulphides vary in the different deposits and the variation appears to be at least partly dependent on temperature conditions at the time of formation.

Close to the intrusive bodies, like in the vicinity of the Robson property, the abundant sulphides are pyrite and arsenopyrite; at greater distances these may be accompanied by sphalerite, galena, and sulphantimonite minerals, such as jamesonite, as conspicuous constituents.

In the vicinity of the Robson property which lies north of the Coast Range intrusive body, there are three properties lying south of the main stock; these properties; Lucky Jem, Northern Light and Lucky Strike, have shown the following mineralization, as observed in 1937.

Lucky Jem:	Narrow veins and nodular masses of mixed pyrite and gold-bearing arsenopyrite as principal economic mineral, in both the intrusive and intruded altered rock.
Northern Light:	Narrow quartz-sulphide veins and veinlets mineralized with arsenopyrite, pyrite and sphalerite, which follow fractures and shear zone in the intrusive masses.
Lucky Strike:	Vein matter consisting of a mixture of arsenopyrite, zinc blende, Jamesonite, and pyrite in variable proportions. Gangue minerals include quartz, calcite, and bright green mariposite.

Robson

Small veins composed mainly of arsenopyrite and carrying gold were explored about 1912. These veins intersected a decomposed granitic intrusion near the head waters of Nea Creek, a tributary of Bon (Bonanza) Creek.

The principal showing lies at an elevation of 6000 feet on a small southwestern tributary of Nea Creek. It was

examined (1939) by Crickmay, who reported it to be a mineralized shear zone averaging about 18 inches in width, striking south west and dipping 36 degrees northwest. The shear intersects highly altered sedimentary rocks near the north west tip of a broad area of batholithic intrusions. It has been developed (1940) by two adits, 200 and 40 feet long respectively, and explored by open-cuts and 700 feet of diamond drilling. A sample collected in 1939 by Crickmay across the shear zone and assayed by the Bureau of Mines, Ottawa, ran 0.99 ounces in gold a ton. At that time the main adit was only in about 20 feet and the owners were shipping out ore on horse back at the rate of about 2 tons a day. Much of this ore was said to run over 3 ounces in gold per ton and also high in silver. The ore consists of an intimate mixture of several sulphides of which the most abundant are a grey lead-sulphantimonite, resembling jamesonite, a black, cupriferous mineral of doubtful identity and zinc blende. Some arsenopyrite is also present and a trace of tin was noted in analytical studies. The occurrence of the antimony bearing mineral is somewhat analogous to that of the abundant jamesonite in the upper Lucky Strike workings in Taylor Basin. The two showings are on opposite sides of and at about the same distance from the main body of intrusive rocks occupying the divide at the head-waters of Taylor, Eldorado, and Bon Creeks. Within this intrusion, or in the larger dyke-like apophyses that radiate from it, the common vein minerals seem to be arsenopyrite and pyrite.

Mineralography

Mineralogy

The specimens examined consist of 30 hand-specimens ranging in size from 5"x4"x3" to 1"x$\frac{3}{4}$"x$\frac{1}{2}$" and 10 polished sections with polished surfaces varying from 2$\frac{1}{2}$"x2" to $\frac{3}{4}$"x$\frac{3}{4}$". About 50% of every specimen is of metallic minerals and the rest of non-metallic. The mineralographic study of the group of specimens has revealed the following minerals listed in the order of abundance and given in detail on the following pages.

Metallic	Non-metallic
Arsenopyrite	Quartz
Antimony sulpho-salts:	Calcite
Zinkenite	Brownish mass mainly
Jamesonite	Sericite
Tetrahedrite	
Pyrite	
Sphalerite	
Gold	

Alteration

Mainly limonite

What is the yellow alteration Bindheimite?

Metallic

Arsenopyrite: FeAs S (main contain some Au Sb) ?

White with a faint creamy tint, high reflectivity slightly lower than for pyrite. Hard (6 F+) rough polish,

stands out on polished section. Monoclinic crystals occur as perfect prisms and diamond shape section of crystals. Strong anisotropism brings out crystal faces and twinning. Etch tests: negative for all reagents except for HNO_3 and Aquaregia. The idiomorphic crystals with characteristic rhomb-shaped cross-section occur in a quartz gangue as prisms of 7-8 m.m. long or minute grains.

Sb - Sulpho-salts:

Zinkenite: $PbS . Sb_2 S_3$

White moderately high reflectivity, soft, hardness (G) Good polish. Hexagonal crystals but appear mainly massive. Moderate anisotropism (light to dark grey) sections perpendicular to elongation appear isotropic. Etch tests: Aqua regia stains brown, HNO_3 effervescence, quickly stains black. HCl fumes tarnish light brown. KOH strong irridescent and light brownish stain. Other reagents, $HgCl_2$, KCN, $FeCl_2$ negative. Microchemical tests; positive for Pb and Sb. Zinkenite is very difficult to distinguish from the other Pb - Sb -S mineral in polished section. Occurs close to arsenopyrite, mainly in quartz gangue but there are also some Sb - sulpho-salts in calcite.

Jamesonite: $4PbS . FeS\ 3Sb_2S_3$

White, high reflectivity, fine polish. Soft, hardness B+. Monoclinic crystals, fine needlelike prism showing characteristic transverse cleavages. Strong anisotropism, grey

to dark bluish grey, basal section nearly isotropic. Twinning lamellae, parallel to elongation, common in some grains. Etch tests: Aqua regia; effervescence, black tarnish, HNO_3 irridescent stain, KOH stains faintly irridescent, other reagents negative. Occurs mainly as minute inclusions in zinkenite and tetrahedrite in a quartz gangue and also as fine needle-shaped crystals in sphalerite.

Tetrahedrite: $5\ Cu_2S^{-1}\ .\ 2\ (Cu,Fe)\ S\ .\ 2Sb_2S_3$ Where do they find these formulae?
(some Zn may be present)

Light olive grey with a brownish tint, lighter than sphalerite, good polish, moderate reflectivity, higher than sphalerite. Hardness D. Isometric crystals, isotropic, complete extinction. Etch tests: Aqua regia; positive, HGl, HNO_3 doubtful, negative for other reagents. Positive microchemical test for Gu.? Cu. Occurs as more or less rounded grains enclosed in zinkenite and quartz, near arsenopyrite.

Pyrite: FeS_2 (may contain some Co,As) ?

Yellowish white, more yellowish color than arsenopyrite. Polished with difficulty because of hardness (F^-) stands out on polished surface. High reflectivity. Isometric crystals, isotropic, idiomorphically developed coarser grains (up to 2 - 3 m.m.) showing rectangular and square outlines, and also very fine individual idiomorphic crystals and aggregates. Etch tests: HNO_3 light stain, all others negative. Occurs in brownish, soft, granular groundmass (sericitized wall rock?)

and in quartz gangue close to arsenopyrite. Contains, in some cases, inclusion of arsenopyrite and zinkenite.

Sphalerite: ZnS

Grey, polish with difficulty, low reflectivity. Hardness D. Isotropic, showing yellowish brown internal reflection. Cleavages visible. Etch tests are of no importance for identification. Positive microchemical tests for Zn. Occurs as large rounded grains (phenocryst like) up to 15 m.m. giving to the hand specimen a characteristic spotted light brown aspect, against the grayish surrounding mass of arsenopyrite, antimony-sulpho-salt and quartz.

Gold: Au

Bright ("golden") yellow, easily polished, scratched, very high reflectivity. Soft (B). Isometric, isotropic greenish incomplete extinction. Etch tests: KCN etch black, Aqua regia, light stain, all others negative. Occurs as isolated minute grains included in arsenopyrite. Only four fine grains have been seen.

Non-metallic

Quartz: SiO_2

Mainly colorless quartz, constitute the major part of the gangue. Occurs as fine to medium size grains surrounding and cutting metallic minerals or as elongated prisms about parallel with arsenopyrite and perpendicular to fracture walls.

Calcite: $CaCO_3$

White to medium grey, from very fine grains, in veinlets or surrounding antimony sulpho-salts, to coarse idiomorphic crystals (15 - 20 m.m.), the latter not mineralized.

Alteration:

Many specimens show rusty-yellowish coating of limonite alteration, probably by oxydation of the iron in pyrite and sphalerite. The calcite is partly dissolved at places and there are signs of partial leaching of silica on some specimens.

Texture

The different minerals occur in a fairly definite relationship, which can be summarized as follows, for the whole group of specimens, by a division in three main zones:

Zone A: Altered wall rock, mainly sericite (alunite) containing or not a small amount of idiomorphic fine grains of pyrite and/or arsenopyrite.

Zone B: Followed by quartz either massive, medium size crystals containing medium size grains of arsenopyrite and pyrite, or, prisms of quartz and arsenopyrite parallel to each other and perpendicular, or nearly, to the wall rock. The arsenopyrite-quartz band contains also at places some large sphalerite crystals which are also present in the next zone.

Zone C: Consisting of mainly quartz-antimony-sulpho-salts (mainly zinkenite). The zinkenite, jamesonite and tetrahedrite are believed to have a simultaneous origin and definitely replace the majority of the arsenopyrite and probably part of the sphalerite. One sample in particular shows the antimony-sulpho-salts in a calcite gangue.

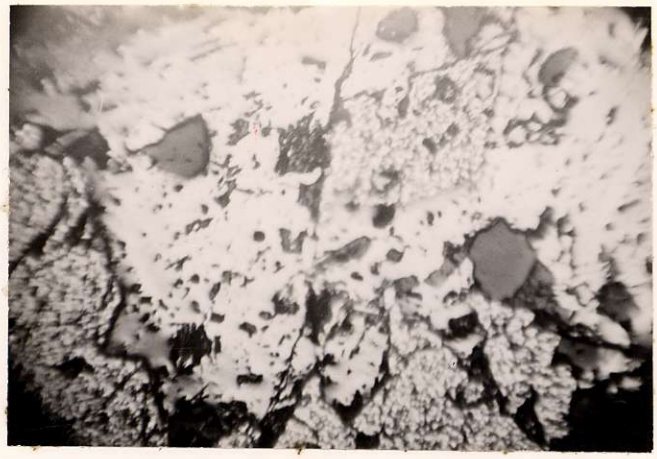
The following microphotographs show detailed textural relationships of the minerals.

X 75

Zone A_ Altered wall rock (sericitized or alunitized) cut by quartz veinlets (medium grey) and including idiomorphic arsenopyrite (white)

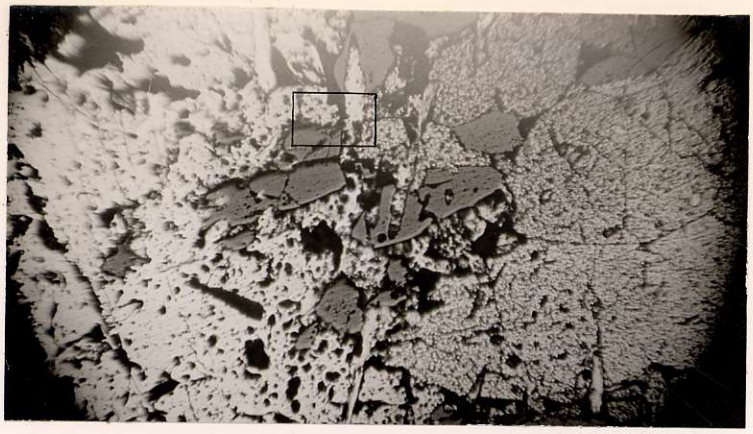
X 75

Zone B- Typical idiomorphic prisms and rhomb-shaped sections of arsenopyrite (white) in a coarse grained quartz gangue (grey). The small dark areas are cavities on polished section due to grain contacts and fractures



x 75

Zone B-C- Replacement texture of idiomorphic arsenopyrite (pitted) by antimony-sulpho-salts (mainly zinkenite) (white)



X 25

X 225

Left: Zone C ? Right: Zone B

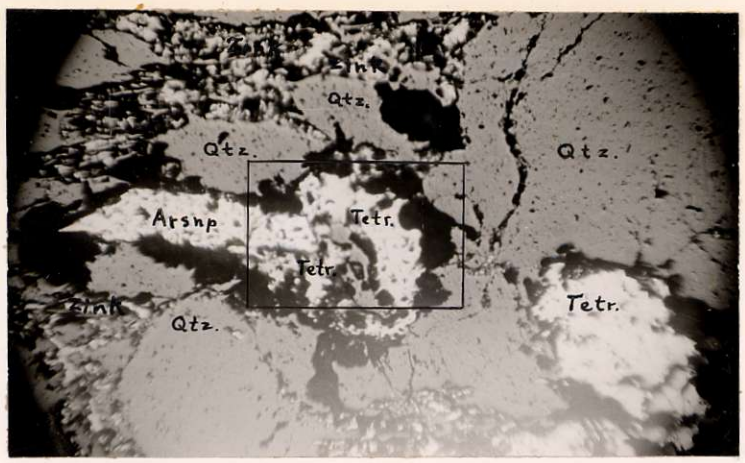
Contacts of main replacing zone (C) of antimony-sulpho-salts (mainly zinkenite) (whitish grey) with primary arsenopyrite, zone (B) (pitted medium grey), both in a crystalline quartz gangue (darker grey)

X 75

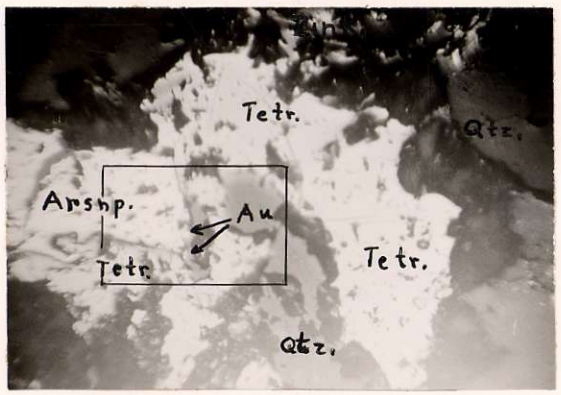
X 75

Microphotographs of different polished sections

Zone C- antimony-sulpho-salts (mainly zinkenite) (light grey) replacing arsenopyrite (darker grey), which is still partly idiomorphic.
All in a quartz gangue (dark grey-black areas)



X 25



X 75

X 225

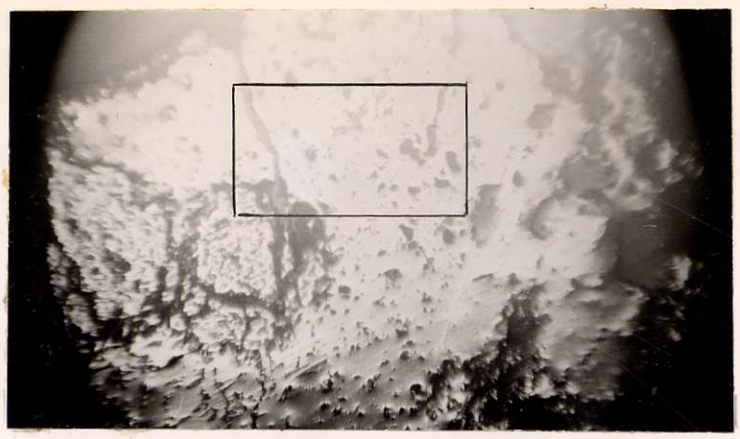
Zone C- Gold-bearing arsenopyrite partly replaced by tetrahedrite in a quartz gangue (medium grey) Dark grey-black areas are fractyres and cavities in polished section

Arsnp.-Arsenopyrite

Tetr. -Tetrahedrite

Zink. -Zinkenite

Qtz. -Quartz



X 75

X 225

Zone C- Massive replacement of arsenopyrite (left of microphotograph,pitted) by zinkenite (light grey) in a quartz gangue (darker grey) Veinlet of quartz,(left of photo) probably secondary quartz

X 75

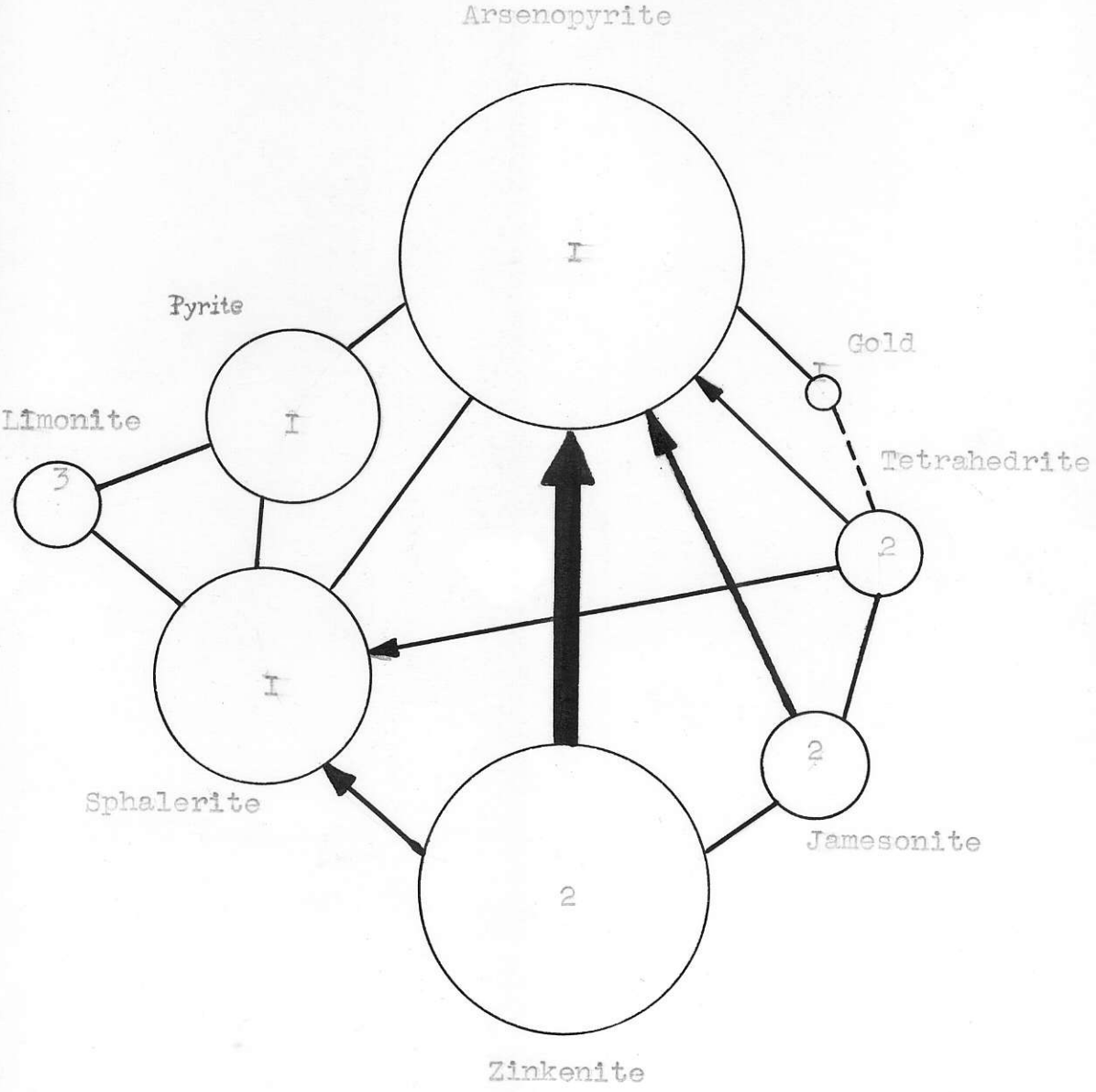
Zone C- Antimony-sulpho-salts (mainly zinkenite)(light grey) in quartz gangue (darker grey)

Paragenesis

The Robson mineral deposit occurs within half a mile from the Coast Range stock which is probably responsible for the intense fracturing and faulting of the sedimentary host rock. The igneous body produced the contact metamorphic aureole and deposit with the help of hydrothermal solutions travelling easily through the provided channelways of fractures and fault systems.

According to the mineralization and textural relationships of the specimens studied the writer proposes the summarized history of mineralization as follows:

1. Intrusion of dioritic stock - fracturing of country rock.
2. Contact metamorphism, wall rock alteration, cavity filling of fractures giving comb structure of quartz and arsenopyrite - replacement of host rock by pyrite, gold-bearing arsenopyrite, sphalerite and quartz. Elements carried by high temperature hydrothermal solutions or gases.
3. Introduction of, later antimony sulpho-salts (probably simultaneously zinkenite, jamesonite, tetrahedrite) which produce a massive replacement of a major part of the arsenopyrite and probably some sphalerite and quartz. Elements brought up by lower temperature hydrothermal solutions.



Vandeerveer Diagram of Paragenetic Relations

of the Ore Minerals

I -Hypogene primary minerals
2 -Hypogene primary minerals
3 -Supergene alteretion mineral

4. Carbonate solutions segregated from country rock during last stage of contact metamorphism or brought up later by low temperature hydrothermal solutions, including also probably some secondary low temperature quartz.
5. Much later, supergene leaching, and alteration, mainly oxydation of iron bearing sulfurs producing limonite-goethite coating.

Conclusions

The group of specimens studied indicate the Robson property to be a high temperature gold-bearing arsenopyrite, contact metamorphic deposit, followed by metasomatic replacement by antimony-sulpho-salt (meso-epithermal). This deposit is probably of shallow depth and the specimens indicate a very fine-grained (microscopic) gold which might carry traces of antimony, and be an ore refractory to cyanadation.

?

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